Subject Index

A
Abies spp.
  Phellinus weirii and forest structure, 518–19, 529, 531–32
Abiotic factors
  advances in plant health management and, 95–113
  citrus blight and, 186
Absolute yield
  advances in plant health management and, 95, 99
Acetobacterium spp.
  ecology and biogeography of microorganisms on plant surfaces, 156
Active oxygen
  photoactivated *Cercospora* toxin cercosporin and, 461–83
Actual yield
  advances in plant health management and, 99–102
Aeciospores
  rust fungi and, 58–59
Aerobiology
  advances in plant health management and, 95, 107–9
  dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 551–53
  epidemiology as a science of patterns and, 71, 76
  wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 503–4
Affordable yield
  advances in plant health management and, 95, 99–100
Africa
  rust fungi and, 51
Aggregate risk
  Food Quality Protection Act and, 577, 581–83
Agricultural base
  declining
    a century of progress in plant pathology and, 1–16
Agriculture
  dispersal and spatial analysis of *Phytophthora*-caused epidemics, 568–69
  Food Quality Protection Act and, 577–94
Agrobacterium tumefaciens
  advances in plant health management and, 112
  a century of progress in plant pathology and, 4
  host-parasite interactions and, 35
  plant viruses and, 129, 137
Agrochemical industry
  Food Quality Protection Act and, 589–90
Agrocybe aegerita
  horizontal gene transfer in fungal evolution and, 334
Agroinfection
  plant viruses and, 129
Alberta
  Phellinus weirii and forest structure, 520
Aleyrodidae
  closteroviruses and, 298
Alfalfa mosaic virus
  plant viruses and, 131
Allomyces spp.
  horizontal gene transfer in fungal evolution and, 334
Alternaria spp.
  ecology and biogeography of microorganisms on plant surfaces, 155, 159
  host-parasite interactions and, 38
Amino acids
  citrus blight and, 190
  closteroviruses and, 299, 305, 307–8
  ecology and biogeography of microorganisms on plant surfaces, 150
  horizontal gene transfer in fungal evolution and, 327, 334, 336–37
  host-parasite interactions and, 39
  plant viruses and, 123
Amplicons
  molecular diagnostic technologies and, 217–18
Anaerobic fungi
  horizontal gene transfer in fungal evolution and, 341–43
Anastomoses
  mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Androgens
  Food Quality Protection Act and, 583
Angola
  rust fungi and, 51
Animal-parasite interactions

of microorganisms on plant surfaces, 154, 159
Bacillus thuringiensis
advances in plant health management and, 107, 109
ecology and biogeography of microorganisms on plant surfaces, 159
Food Quality Protection Act and, 590
Bacteria
biological control of nematodes and, 423–37
cell biology imaging of plant-microbe interactions and, 443–45
a century of progress in plant pathology and, 2–4, 8
citrus blight and, 188, 194–95
ecology and biogeography of microorganisms on plant surfaces, 145, 158, 161
Food Quality Protection Act and, 590
host-parasite interactions and, 35–39, 42
lipopolysaccharides and, 241–56
molecular diagnostic technologies and, 207–29
nematode parasitism genes and, 365–88
plant viruses and, 129
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Bacterial leaf spot
host-parasite interactions and, 42
Bacterial wilt disease
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Bakanae disease
a century of progress in plant pathology and, 9
Barberry eradication
epidemiology as a science of patterns and, 83–84
Basidiospores
rust fungi and, 49, 58
BB statistics
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 554–56
Bemicia spp
closteroviruses and, 298, 302
Benchmark yield
for crops
advances in plant health management and, 98–101
Bewildering epidemics
epidemiology as a science of patterns and, 79–80
Binary data
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 554–56
Biochemistry
a century of progress in plant pathology and, 6–7
Biochips
molecular diagnostic technologies and, 227–28
Biofilms
ecology and biogeography of microorganisms on plant surfaces, 163–65
Biogeography
microorganismal, 145–71
Biological control
advances in plant health management and, 95, 109–11
mitochondrial DNA in fungal senescence and hypovirulence, 397, 415–16
Biosynthesis
photoactivated *Cercospora* toxin cercosporin and, 461–83
Biotechnology
a century of progress in plant pathology and, 1–16
host-parasite interactions and, 40–41
Biotic factors
advances in plant health management and, 95–113
citrus blight and, 186
BLASTN program
horizontal gene transfer in fungal evolution and, 335
BLASTP program
horizontal gene transfer in fungal evolution and, 341
Blight-associated proteins
citrus blight and, 185–87, 190
"Boom and bust" cycle
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Bootstrapping
closteroviruses and, 305
Botrytis spp.
host-parasite interactions and, 33
Boundary layers
epidemiology as a science of patterns and, 78
Brassica campestris
bacterial lipopolysaccharides and, 243
Brazil
citrus blight and, 181, 184–86, 189, 191–92
rust fungi and, 51

nematode parasitism genes and, 365–88
Anoxic sediment
ecology and biogeography of microorganisms on plant surfaces, 145–71
Antagonism
microbes for nematode control, 431–33
Antioxidants
photoactivated *Cercospora* toxin cercosporin and, 476–81
Antomicrobial compounds
bacterial lipopolysaccharides and, 241–56
Aphanomyces etuiches
advances in plant health management and, 108
Aphids
closteroviruses and, 293–94, 301–2, 315
Aphis fabae
closteroviruses and, 298
Aplodontia rufa
Phellinus weirii and forest structure, 525
Apple chlorotic leafspot
molecular diagnostic technologies and, 212
Apple scab
epidemiology as a science of patterns and, 82
Apple stem pitting virus
molecular diagnostic technologies and, 212
Appressoria
rust fungi and, 49–62
Arabidopsis thaliana
bacterial lipopolysaccharides and, 243, 247–49, 256
citrus blight and, 190
horizontal gene transfer in fungal evolution and, 331
host-parasite interactions and, 32, 36–39, 42–43
Arbutus menziesii
Phellinus weirii and forest structure, 518
Arceuthobium spp.
Phellinus weirii and forest structure, 530
Archaea
ecology and biogeography of microorganisms on plant surfaces, 145, 157
Argentina
citrus blight and, 181, 189, 192
Armillaria ostoyae
Phellinus weirii and forest structure, 531
Ascobolus immersus
horizontal gene transfer in fungal evolution and, 329–30, 340
Asexual transmission
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Asia
Phellinus weirii and forest structure, 521
Aspergillus spp.
advances in plant health management and, 110
horizontal gene transfer in fungal evolution and, 331–34, 337, 343
mitochondrial DNA in fungal senescence and hypovirulence, 406
Atkinsonella hypoxylon
horizontal gene transfer in fungal evolution and, 331
Attainable yield
advances in plant health management and, 95, 99
Attenuating viruses
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Aureobasidium spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Australia
advances in plant health management and, 109–10
plant viruses and, 121
rust fungi and, 59
Autocorrelation
spatial
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 554–56, 558–60
Average yield
advances in plant health management and, 95, 101
Avirulence
bacterial lipopolysaccharides and, 241–46
Avocado sunblotch viroid
plant viruses and, 128
avr genes
bacterial lipopolysaccharides and, 253–55
a century of progress in plant pathology and, 7–9
host-parasite interactions and, 36–37
rust fungi and, 57, 59
Axenic culture
rust fungi and, 59
Azospirillum lipoferum
ecology and biogeography of microorganisms on plant surfaces, 154

B

Bacillus subtilis
ecology and biogeography

Central America
epidemiology as a science of patterns and, 84
rust fungi and, 50
Cercospora toxin cercosporin
photoactivated
antioxidant defense, 476–81
conclusions, 483
introduction, 461–63
photosensitizer resistance, 463–65, 469–74
plant pathogenesis, 465–69
pyridoxine, 476–81
regulation of production, 481–83
resistance genes, 474–76
Ceylon
epidemiology as a science of patterns and, 75, 88
rust fungi and, 51
Chaetomium spp.
ecology and biogeography of microorganisms on plant surfaces, 155
Character-state discordance
horizontal gene transfer in fungal evolution and, 327
Chemotaxis
molecular diagnostic technologies and, 215
Chemotherapy
viral
plant viruses and, 123
Chenopodium spp.
citrus blight and, 192, 194
plant viruses and, 120
Cherry mottle leaf virus
molecular diagnostic technologies and, 223
Chestnut blight
epidemiology as a science of patterns and, 75
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Children
Food Quality Protection Act and, 577–94
Chimeric genomes
closteroviruses and, 310–11
China
advances in plant health management and, 103
epidemiology as a science of patterns and, 88
Chlamydomonas spp.
horizontal gene transfer in fungal evolution and, 335, 343
Chloramphenicol
citrus blight and, 197
Chlorosis
citrus blight and, 181, 190–91
Chlorothalonil
Food Quality Protection Act and, 587
Chromosomes
horizontal gene transfer in fungal evolution and, 325, 351–52
Citrus blight
abiotic factors, 186
associated proteins, 190
biotic factors, 186
citrus blight, 184
citrus psorosis, 191–93
citrus variegated chlorosis, 190–91
conclusions, 198–99
diagnostic tests, 185–86
diseases of complex etiology, 195–98
dry root rot–sudden death, 198
experimental transmission, 186–87
history, 184–85
introduction, 182–83
lettuce big vein, 193–95
looking for cause, 188–89
movement, 187–88
overview, 183–84
peach tree short life, 195–96
replant diseases and, 196–97
Rio Grand gummosis, 197–98
rootstocks and, 189–90
Citrus spp.
citrus blight and, 181–99
Cladosporium spp.
bacterial
lipopolysaccharides and, 254
ecology and biogeography of microorganisms on plant surfaces, 155, 159
Clean planting material
advances in plant health management and, 102–3
Clean tillage
advances in plant health management and, 95, 104
Clearcutting
Phellinus weirii and forest structure, 532
Cleavage
DNA
cell biology imaging of plant-microbe interactions and, 443, 452
Cloning
host-parasite interactions and, 31–44
nematode parasitism genes and, 365–88
plant viruses and, 129
Closteroviruses
aphid-transmitted closteroviruses, 301–2
biology, 294–99, 311–12
chimeric genomes, 310–11
conclusions, 314–15

Britain
epidemiology as a science of patterns and, 87–88
British Columbia
Phellinus weirii and forest structure, 517, 519–20, 522
Brome mosaic virus
plant viruses and, 127
Bromus spp.
host-parasite interactions and, 33
BW statistics
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 554–56

C

Ca^{2+}
cell biology imaging of plant-microbe interactions and, 443–55
Caenorhabditis elegans
nematode parasitism genes and, 365–88
California
advances in plant health management and, 107
citrus blight and, 184–85
closteroviruses and, 310
epidemiology as a science of patterns and, 76
Food Quality Protection Act and, 585
Phellinus weirii and forest structure, 519–20, 531
Canada
epidemiology as a science of patterns and, 88
molecular diagnostic technologies and, 213
Phellinus weirii and forest structure, 517, 519–20, 522
rust fungi and, 50
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 493–94
Candida norvegesis
horizontal gene transfer in fungal evolution and, 343
Canker
citrus blight and, 195
Canopy dispersal
wheat leaf/stem rust epidemiology in central Great Plains of USA, 501–3
Canopy gaps
Phellinus weirii and forest structure, 515, 517, 522, 524–26
Capsicum annum
bacterial lipopolysaccharides and, 243
Capsid proteins
citrus blight and, 193
Captan
Food Quality Protection Act and, 587
Carbamates
Food Quality Protection Act and, 587
Carcinogens
Food Quality Protection Act and, 581, 589
Caribbean Basin
citrus blight and, 197
Carlaviridae
plant viruses and, 125
Cascade Mountains
Phellinus weirii and forest structure, 517–20, 522–29, 531, 533–36
Catalases
horizontal gene transfer in fungal evolution and, 343
Catastrophic tissue damage
bacterial lipopolysaccharides and, 241–48, 252–56
Cauliflower mosaic virus
plant viruses and, 124
Caulimoviridae
plant viruses and, 125
Cell biology imaging
of plant-microbe interactions
conclusions, 453–55
confocal laser scanning microscopy, 446, 448
cytoskeleton rearrangements, 451–52
cytosolic calcium levels, 450–51
DNA cleavage, 452
fluorescent probes, 449–51
green fluorescent protein, 449–50, 452–53
imaging techniques, 446–50
integration of imaging techniques, 453
introduction, 444–46
laser processing, 448
reactive oxygen species, 451
selected examples, 450–52
video microscopy, 446–47
visualizing and tracking gene products, 449–50
Cell surface structure
bacterial lipopolysaccharides and, 241–56
Cellulolytic enzymes
Ralstonia solanacearum
virulence and pathogenicity gene control, 269
Cell wall-degrading enzymes
Ralstonia solanacearum
virulence and pathogenicity gene control, 263–84

lipopolysaccharides and, 250–51
Cowpea mosaic virus
plant viruses and, 122
Crataegus spp.
rust fungi and, 59
Criconemella xenoplax
citrus blight and, 196
Crops
advances in plant health management and, 95, 98–102
closteroviruses and, 293–315
Food Quality Protection Act and, 577, 583–89
rust fungi and, 49–62
Crosses
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Cross protection
plant viruses and, 120
Cryphonectria parasitica
horizontal gene transfer in fungal evolution and, 331–32
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Cryptococcus spp.
ecology and biogeography of microorganisms on plant surfaces, 155, 159
Cucumber mosaic virus
plant viruses and, 126
Cumulative risk
Food Quality Protection Act and, 577, 581–83
Cyanobacteria
ecology and biogeography of microorganisms on plant surfaces, 154, 158
Cylindrocarpon spp.
citrus blight and, 197
Cylindrocladium spp.
molecular diagnostic technologies and, 220
Cymbidium mosaic virus
molecular diagnostic technologies and, 223
Cysteine
citrus blight and, 190
Cysts
microbes for nematode control, 423–37
nematode parasitism genes and, 365–88
Cytomegalovirus
plant viruses and, 130
Cytopathology
closteroviruses and, 298–99
Cytoplasm
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Cytoskeleton
cell biology imaging of plant-microbe interactions and, 443, 451–52
Cytosol
cell biology imaging of plant-microbe interactions and, 443, 450–51
Cytospora spp.
citrus blight and, 195
ecology and biogeography of microorganisms on plant surfaces, 159

D

Dayapyrum villosum
advances in plant health management and, 108
Decision-support systems
advances in plant health management and, 95–97, 112–13
Decline
grapevine
molecular diagnostic technologies and, 210
Defective interfering viruses
plant viruses and, 126
Defective RNAs
closteroviruses and, 309–10
Defense-related responses
bacterial
lipopolysaccharides and, 241, 246–53
Degeneration
grapevine
molecular diagnostic technologies and, 210
Delaney Clause
Food Quality Protection Act and, 580–81
Demographic processes
ecology and biogeography of microorganisms on plant surfaces, 165–66
Dendroctonus pseudotsugae
Phellinus weirii and forest structure, 524
Dendrophoma spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Deposition
epidemiology as a science of patterns and, 78–79
Desulfobulbus spp.
ecology and biogeography of microorganisms on plant surfaces, 156–57
Desulfovibrio spp.
ecology and biogeography of microorganisms on plant surfaces, 156–57
Detection
pathogen
plant viruses and, 117–38
"Detectives"
disease
epidemiology as a science of patterns and, 71–73
Defective interfering viruses
plant viruses and, 126
Defective RNAs
closteroviruses and, 309–10
Defense-related responses
bacterial
lipopolysaccharides and, 241, 246–53
Degeneration
grapevine
molecular diagnostic technologies and, 210
Delaney Clause
Food Quality Protection Act and, 580–81
Demographic processes
ecology and biogeography of microorganisms on plant surfaces, 165–66
Dendroctonus pseudotsugae
Phellinus weirii and forest structure, 524
Dendrophoma spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Deposition
epidemiology as a science of patterns and, 78–79
Desulfobulbus spp.
ecology and biogeography of microorganisms on plant surfaces, 156–57
Desulfovibrio spp.
ecology and biogeography of microorganisms on plant surfaces, 156–57
Detection
pathogen
plant viruses and, 117–38
"Detectives"
disease
epidemiology as a science of patterns and, 71–73

cytopathology, 298–99
defective RNAs, 309–10
epidemiology, 300–4
evolution, 304–9, 311–12
genetic diversity, 300–4, 309–13
helicases, 305–6
HSP70 gene, 306–7
introduction, 294
mealybug-transmitted closteroviruses, 304
molecular biology, 299–300
molecular diagnostic technologies, 211, 224
morphology, 294–99
overview, 294–99
phylogeny, 304–9
practical implications, 312–13
range of viruses, 294–98
RdRp motifs, 306
recombination, 309–11
taxonomy, 313–14
tissue tropism, 298–99
transmission, 298
unknown vectors, 300–1
vectors, 308
whitefly-transmitted closteroviruses, 302–4
Clostridium spp.
ecology and biogeography of microorganisms on plant surfaces, 157
CLUSTALX program
closteroviruses and, 305, 307
Clusters
gene
dispersal and spatial analysis of *Phytophthora*-caused epidemis, 557
horizontal gene transfer in fungal evolution and, 345–51
Coastal Ranges
Phellinus weirii and forest structure, 517, 520
Coat proteins
citrus blight and, 193
TMV
plant viruses and, 122–23
Cochliobolus carbonum
a century of progress in plant pathology and, 9
host-parasite interactions and, 36, 38
Coevolution
closteroviruses and, 293–15
Coffee rust
epidemiology as a science of patterns and, 75, 88
rust fungi and, 49, 51
Colletotrichum gloeosporiodes
horizontal gene transfer in fungal evolution and, 340
Colletrichum acutatum
dispersal and spatial analysis of Phytophthora-caused epidemics, 563
Colonization factors
Ralstonia solanacearum virulence and pathogenicity gene control, 279–80
Colorado
epidemiology as a science of patterns and, 83
Columbia River Basin
Phellinus weirii and forest structure, 517, 534
Commensals
ecology and biogeography of microorganisms on plant surfaces, 145–71
Communications
a century of progress in plant pathology and, 1–16
Complex multicomponent control
Ralstonia solanacearum virulence and pathogenicity gene control, 277–78
Computer modeling
epidemiology as a science of patterns and, 82
Confocal laser scanning microscopy
cell biology imaging of plant-microbe interactions and, 446, 448
Conifer forests
Phellinus weirii and forest structure, 515–36
Connecticut
epidemiology as a science of patterns and, 76, 84–85
Conserved sequences
molecular diagnostic technologies and, 207–29
Consumer acceptance
advances in plant health management and, 107
Consumer costs
Food Quality Protection Act and, 577–94
Contagious distribution
epidemiology as a science of patterns and, 75
Continuous data
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
Coprinus spp
citrus blight and, 198
horizontal gene transfer in fungal evolution and, 337
Copy DNA (cDNA) clones
plant viruses and, 129
Cosuppression
plant viruses and, 133–34
Coumaroyl-tyramine
bacterial

Phellinus weirii and forest structure, 515, 532–33
Electron microscopy
cell biology imaging of plant-microbe interactions and, 443–55
Electrophoresis
molecular diagnostic technologies and, 217–18
Eleusine spp.
horizontal gene transfer in fungal evolution and, 338
Endocrine disruption
Food Quality Protection Act and, 577, 583, 589
Endophytes
ecology and biogeography of microorganisms on plant surfaces, 145–71
Environmental factors
advances in plant health management and, 95–138
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Environmental heterogeneity
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
Enzyme-linked immunosorbent assay (ELISA)
molecular diagnostic technologies and, 207–29
Epicoccum spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Epidemics
citrus blight and, 181–99
dispersal and spatial analysis of *Phytophthora* spp. and, 541–70
epidemiology as a science of patterns and, 71, 75–82
rust fungi and, 49–62
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Epidemiology
closteroviruses and, 300–4
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 567–68
molecular diagnostic technologies and, 207–29
rust fungi and, 49–62
as a science of patterns
aerobiology, 76
bewildering epidemics, 79–80
computer models, 82
crops, 84
deposition, 78–79
dilution, 78–79
disease loss, 85–87
diversity, 83–85
dollars, 86–87
epidemics, 75–76, 79–82
fungicide, 84–85
future research, 89–90
gradients, 77–78
introduction, 72–74
logistic curve, 80, 82
long-term bets, 88–89
managing disease, 87–89
matching pathogen and host genes, 82–85
measuring disease, 74–75
new pathogens, 75
patterns, 72–73
plant epidemiology compared to medical, 73
quarantines, 75–76
short-term decisions, 87–88
spreading within a locality, 77–79
state of epidemiology in 1900, 73–74
take-off, 78
tons, 85–86
traps, 77–78
weather, 77
wheat leaf/stem rust central Great Plains of USA and, 491
Epiphytes
ecology and biogeography of microorganisms on plant surfaces, 145–65
epidemiology as a science of patterns and, 73
eps promoter
Ralstonia solanacearum virulence and pathogenicity gene control, 276–78
Erwinia spp.
bacterial lipopolysaccharides and, 243, 254
host-parasite interactions and, 37
molecular diagnostic technologies and, 226
Escape
wheat leaf/stem rust epidemiology in central Great Plains of USA, 509
Escherichia coli
bacterial lipopolysaccharides and, 243, 246, 252, 254
horizontal gene transfer in fungal evolution and, 328, 335
host-parasite interactions and, 36
plant viruses and, 129
Esophageal gland cells
nematode parasitism genes and, 365–88
Estrogenic effects
Food Quality Protection Act and, 583

Determinants
bacterial
lipopolysaccharides and, 241–56
Difenconazole
citrus blight and, 197
Differential varieties
epidemiology as a science of patterns and, 71–90
Differentiation
molecular diagnostic technologies and, 217–18
Dilution
epidemiology as a science of patterns and, 78–79
Direct molecular analysis
nematode parasitism genes and, 370–76
Disease control
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Disease cycles
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 544
Disease diagnosis
molecular diagnostic technologies and, 207–29
Disease management
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
epidemiology as a science of patterns and, 87–89
Food Quality Protection Act and, 577–94
molecular diagnostic technologies and, 207–29
Disease measurement
epidemiology as a science of patterns and, 74–75
Disease prediction
advances in plant health management and, 95–97, 112–13
Dispersal
epidemiology as a science of patterns and, 71–90
Phytophthora-caused epidemics and, 541–70
wheat leaf/stem rust epidemiology in central Great Plains of USA, 501–7
Distance indices
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 557–58
Disturbance agents
Phellinus weirii and forest structure, 515–36
Diversity
closteroviruses and, 300–13
ecology and biogeography of microorganisms on plant surfaces, 145–71
epidemiology as a science of patterns and, 71, 83–85
Phellinus weirii and forest structure, 518, 524–25, 531–32
DNA analysis
epidemiology as a science of patterns and, 71–90
DNA cleavage
cell biology imaging of plant-microbe interactions and, 443, 452
DNA probes
molecular diagnostic technologies and, 216
Double-stranded RNA (dsRNA)
citrus blight and, 181, 193–94
Douglas fir
Phellinus weirii and forest structure, 515–36
Drosophila spp.
host-parasite interactions and, 42
Dry root rot–sudden death
citrus blight and, 181, 198
Dutch elm disease
epidemiology as a science of patterns and, 75–76

E

East Africa
rust fungi and, 51
Ebola virus
epidemiology as a science of patterns and, 89
Echinodontium tinctorum
Phellinus weirii and forest structure, 529
Ecology
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
microorganismal, 145–71
molecular diagnostic technologies and, 207–11, 214, 222, 225–26, 229
Phellinus weirii and forest structure, 515
Economics
advances in plant health management and, 95–138
citrus blight and, 181–99
epidemiology as a science of patterns and, 86–87
Food Quality Protection Act and, 577–94
molecular diagnostic technologies and, 223–24
Ecophysiology
ecology and biogeography of microorganisms on plant surfaces, 145, 150–51, 153
Ecosystem management

France
epidemiology as a science of patterns and, 80–81
Fruit
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 550–53
Fuel production
a century of progress in plant pathology and, 1–16
Full genetic potential
advances in plant health management and, 98
Functional genomics
nematode parasitism genes and, 365–88
Fungi
bacterial lipopolysaccharides and, 254
a century of progress in plant pathology and, 5–6, 9
citrus blight and, 181–99
horizontal gene transfer in fungal evolution and, 325–53
microbes for nematode control, 427–28
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
molecular diagnostic technologies and, 207–29
nematophagous biological control and, 423–37
Phellinus weirii and forest structure, 515–36
photoactivated Cercospora toxin cercosporin and, 461–83
rust fungi and, 49–62
Fungicides
epidemiology as a science of patterns and, 71, 74, 82, 84–85, 88–89
Food Quality Protection Act and, 577, 586–88, 590–91
Furoviridae
plant viruses and, 125
Fusarium spp.
advances in plant health management and, 98, 108
citrus blight and, 188, 198
horizontal gene transfer in fungal evolution and, 331, 338–39
host-parasite interactions and, 33, 35
molecular diagnostic technologies and, 215, 220

G

Gaeumannomyces graminis
advances in plant health management and, 103, 108
horizontal gene transfer in fungal evolution and, 335
Geary's *c* ratio
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 558–59
Gene clusters
horizontal gene transfer in fungal evolution and, 325–53
Gene deployment
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 510
Gene-for-gene model
advances in plant health management and, 95–97, 104–5, 108, 110–13
rust fungi and, 49–62
Gene pyramid
wheat leaf/stem rust epidemiology in central Great Plains of USA, 510
Generalist microorganisms
microbes for nematode control, 423–37
Generalized linear models
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 563
Gene silencing
plant viruses and, 117–38
Genetic engineering
citrus blight and, 190
plant viruses and, 117, 130, 132–33
Genetic potential
advances in plant health management and, 95–113
Genetic recombination
plant viruses and, 117–38
Genetics
advances in plant health management and, 98, 106–7, 112
bacterial lipopolysaccharides and, 241, 247–48
cell biology imaging of plant-microbe interactions and, 443–55
a century of progress in plant pathology and, 6–9
citrus blight and, 190
closteroviruses and, 293–315
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
ecology and biogeography of microorganisms on plant surfaces, 145–71
epidemiology as a science of patterns and, 82–85
horizontal gene transfer in

Ethiopia
rust fungi and, 51
Eukaryotes
ecology and biogeography of microorganisms on plant surfaces, 145–71
horizontal gene transfer in fungal evolution and, 325–53
Eupenicillium spp.
ecology and biogeography of microorganisms on plant surfaces, 155
Europe
citrus blight and, 194
epidemiology as a science of patterns and, 88
molecular diagnostic technologies and, 217–19, 228
Evolution
closteroviruses and, 293, 304–12
epidemiology as a science of patterns and, 84
horizontal gene transfer in fungal evolution and, 325–53
nematode parasitism genes and, 365–88
plant viruses and, 135–36
Exopolysaccharide I
Ralstonia solanacearum virulence and pathogenicity gene control, 263, 267–68
Exoproteins
Ralstonia solanacearum virulence and pathogenicity gene control, 268–69
Expansin
citrus blight and, 190
Expressed sequence tag (EST) approaches
nematode parasitism genes and, 365–88

F

Farms
epidemiology as a science of patterns and, 71, 86
Food Quality Protection Act and, 590
Federal statutes
Food Quality Protection Act and, 577–94
Feeding spear
nematode parasitism genes and, 365–88
Feruloyl-tyramine
bacterial lipopolysaccharides and, 250–51
Fiber production
a century of progress in plant pathology and, 1–16
Fibriobacter succinogenes
horizontal gene transfer in fungal evolution and, 341
Filamentous virions
closteroviruses and, 293–315
Fire
Phellinus weirii and forest structure, 515, 522, 533
Flammulina velutipes
horizontal gene transfer in fungal evolution and, 334
Flax rust
advances in plant health management and, 95–97, 100, 104–5, 108–13
Flexuous virions
closteroviruses and, 293–315
Florida
citrus blight and, 184–85, 188–89
closteroviruses and, 310–11
Food Quality Protection Act and, 585
Fluorescent probes
cell biology imaging of plant-microbe interactions and, 443–55
Food production
a century of progress in plant pathology and, 1–16
Food Quality Protection Act (FQPA)
aggregate risk, 581–83
agrochemical industry, 589–90
conclusions, 593–94
crop production, 589
cumulative risk, 581–83
Delaney Clause, 580–81
endocrine disruption, 583
federal statutes relevant to pesticide use, 585
fungicides, 586–88, 590–91
human health and social issues, 590
introduction, 578–80
minor crops, 583–84
overview, 579
pesticide availability, 588–89
policy reactions, 592–93
potential impacts, 588–93
research, 591–92
tolerance establishment, 584–85
Food safety
Food Quality Protection Act and, 577–94
Forest Vegetation Simulator (FVS)
Phellinus weirii and forest structure, 534
Formae speciales
epidemiology as a science of patterns and, 83
horizontal gene transfer in fungal evolution and, 338
rust fungi and, 51–52, 60
Foveavirus
molecular diagnostic technologies and, 212

advances in plant health management and, 110
horizontal gene transfer in fungal evolution and, 329
Helicases
closteroviruses and, 305–6
Helminthosporium spp.
a century of progress in plant pathology and, 4
host-parasite interactions and, 34, 38
Hemileia vastatrix
rust fungi and, 50–51
Heraculum latent vitiviruses
molecular diagnostic technologies and, 212
Heterobasidion annosum
Phellinus weirii and forest structure, 531
Heterodera spp.
microbes for nematode control, 425
nematode parasitism genes and, 365–88
Heterogeneity
genetic
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
habitat
ecology and biogeography of microorganisms on plant surfaces, 169–70
Heterosis
advances in plant health management and, 98
Hexachlorobenzene (HCB)
advances in plant health management and, 102–3
Hm1 gene
a century of progress in plant pathology and, 9
Holmes viral local lesion assay
host-parasite interactions and, 41
Homing
intron
horizontal gene transfer in fungal evolution and, 333, 337
Homoptera spp.
closteroviruses and, 293–315
Hordeiviridae
plant viruses and, 125
Horizontal distribution
urediniospore
wheat leaf/stem rust epidemiology in central Great Plains of USA, 504–5
Horizontal gene transfer
fungal evolution and
catalases, 343
conclusions, 352–53
difficulties working with introns, 336–37
evidence, 326–28
experimental nuclear gene transfer, 344–45
gene clusters, 345–51
globins in nonvertebrate species, 343–44
group I introns in nuclear and mitochondrial rRNA genes, 335–36
group II introns, 336
hydrolytic genes of anaerobic fungi, 341–43
introduction, 326–28
introns, 332–37
"means, motive, and opportunity", 352–53
mitochondrial group I introns, 333–35
mycoviruses, 330–32
nuclear genes, 341–45
perspectives, 352–53
plasmids, 328–30
potential cases of HGT in fungi, 328–30
transposable elements, 337–41
tricothecene 3-O-acetyltransferase, 344
whole chromosomes, 351–52
Horizontal resistance
epidemiology as a science of patterns and, 71–90
Hormones
Food Quality Protection Act and, 583, 589
Horsfall/Barratt scale
epidemiology as a science of patterns and, 74
Host colonization
rust fungi and, 49–62
Host genes
epidemiology as a science of patterns and, 82–85
Host inhibitory responses
plant viruses and, 133–34
Host-parasite interactions
contributions of plant pathology to basic science, 41–42
future research, 42–43
introduction, 31–32
landmark findings leading to the unexpected, 39
ominous trends, 44
philosophical shifts, 39
technology-driven process, 40–41
twentieth century research, 33–39
Host–Pathogen Index
Phellinus weirii and forest structure, 519
Host plants
photoactivated *Cercospora* toxin cercosporin and, 461–83

fungal evolution and, 325–53
host-parasite interactions and, 31–44
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
molecular diagnostic technologies and, 207–29
nematode parasitism genes and, 365–88
photoactivated *Cercospora* toxin cercosporin and, 474–83
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
rust fungi and, 49–62
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 509–10
Genets
Phellinus weirii and forest structure, 521–22
Genomic DNA
molecular diagnostic technologies and, 207–29
Genomic integrity
horizontal gene transfer in fungal evolution and, 341
Georgia
Food Quality Protection Act and, 585
Germany
epidemiology as a science of patterns and, 88
molecular diagnostic technologies and, 228
plant viruses and, 122
Germling development
rust fungi and, 49, 53–55
Germling metabolism
rust fungi and, 55–56
Gibberella spp.
horizontal gene transfer in fungal evolution and, 338
Gliocladium spp.
molecular diagnostic technologies and, 218
Globalization
a century of progress in plant pathology and, 1, 12–14
Globins
horizontal gene transfer in fungal evolution and, 343–44
Globodera spp.
nematode parasitism genes and, 365–88
•-1,3-Glucanase
citrus blight and, 190
Glyphosate
advances in plant health management and, 105
citrus blight and, 187
Food Quality Protection Act and, 590
Gradients
epidemiology as a science of patterns and, 77–78
Gram-negative bacteria
bacterial lipopolysaccharides and, 241–56
Grape phylloxera
epidemiology as a science of patterns and, 89
Grapevine
molecular diagnostic technologies and, 209–14
Grapevine leafroll
molecular diagnostic technologies and, 211
Grapevine rugose wood
molecular diagnostic technologies and, 212–13
Grapevine rupestric stem pitting associated virus
molecular diagnostic technologies and, 212
Great Basin
Phellinus weirii and forest structure, 517
Great Britain
plant viruses and, 121
Great Plains
central
wheat leaf/stem rust epidemiology and, 491
epidemiology as a science of patterns and, 76
Green fluorescent protein
cell biology imaging of plant-microbe interactions and, 443, 449–50, 452–53
Green revolution
advances in plant health management and, 103
Groundnut rosette virus
plant viruses and, 126
Gymnosporium juniperi-virginiana
rust fungi and, 59

H

Habitats
ecology and biogeography of microorganisms on plant surfaces, 145–71
Hairpin ribozyme
plant viruses and, 131
Haiti
horizontal gene transfer in fungal evolution and, 329
Halococcus spp.
ecology and biogeography of microorganisms on plant surfaces, 157
Hammerhead ribozyme
plant viruses and, 131
Harvest
Phellinus weirii and forest structure, 515–36
Haustoria
rust fungi and, 56–57
Hawaii

fungal evolution and, 325, 332–37
Invertebrates
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 553
Ireland
epidemiology as a science of patterns and, 84
Irrigation water
advances in plant health management and, 106–7
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 548–50
Italy
molecular diagnostic technologies and, 213

J

Japan
Phellinus weirii and forest structure, 521

K

Kaleidoscopic patterns
epidemiology as a science of patterns and, 79–80
Kansas
wheat leaf/stem rust epidemiology in central Great Plains of USA, 493, 495, 505–7, 509
Kenya
rust fungi and, 51
Kinetics
bacterial lipopolysaccharides and, 245–46
Klamath Mountains
Phellinus weirii and forest structure, 519
Kluyveromyces lactis
horizontal gene transfer in fungal evolution and, 336
Kocuria spp.
ecology and biogeography of microorganisms on plant surfaces, 154

L

Lactobacillus spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Laminated root rot
Phellinus weirii and forest structure, 515–36
Large-scale testing
molecular diagnostic technologies and, 226–27
Laser processing
cell biology imaging of plant-microbe interactions and, 448
Lasiodiplodia theobromae
citrus blight and, 197
Late Successional Reserves
Phellinus weirii and forest structure, 532–33
Lateral gene transfer
horizontal gene transfer in fungal evolution and, 325–53
nematode parasitism genes and, 365–88
Leafroll
grapevine
molecular diagnostic technologies and, 211
Leaf rust
epidemiology in central Great Plains of USA and, 491–510
Leaf spot
bacterial
host-parasite interactions and, 42
Leaves
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 550–53
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Legacy for the millennium
a century of progress in plant pathology
advent of molecular genetics, 7–9
birth pangs at the turn of the century, 2–3
demise of the generalists, 9–11
genetics and biochemistry supplant physiology, 6–7
introduction, 1–2
keeping the faith, 14–16
of mergers and acquisitions, 11–12
phytobacteriology comes of age, 4
ups and downs of globalization, 12–14
Lettuce big vein
citrus blight and, 181, 193–95
Leucine
host-parasite interactions and, 39
Liebig's law of limiting factors
advances in plant health management and, 98
Life cycles
epidemiology as a science of patterns and, 71–90
Light activation
photoactivated *Cercospora* toxin cercosporin and, 461–83
Light microscopy
cell biology imaging of plant-microbe interactions and, 443–55
Linear models
dispersal and spatial

Host resistance
nematode parasitism genes and, 365–88
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
hrp genes
bacterial lipopolysaccharides and, 241–56
a century of progress in plant pathology and, 8
host-parasite interactions and, 35, 38–39
Ralstonia solanacearum virulence and pathogenicity gene control, 263, 269–70, 280–83
HSP70 gene
closteroviruses and, 293, 306–7
Human health/social issues
Food Quality Protection Act and, 590
Human immunodeficiency virus (HIV)
epidemiology as a science of patterns and, 89
Human movement
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 553
Humoral defense
host-parasite interactions and, 42
Hybridization
molecular diagnostic technologies and, 218
Hybrid vigor
advances in plant health management and, 98
Hydrolytic genes
horizontal gene transfer in fungal evolution and, 341–43
Hydroxycinnamoyl-tyramine conjugates
bacterial lipopolysaccharides and, 241, 249–50
Hypericum perforatum
photoactivated Cercospora toxin cercosporin and, 463, 466
Hypersensitive response
bacterial lipopolysaccharides and, 241, 243–46, 253–55
a century of progress in plant pathology and, 7
host-parasite interactions and, 32, 39
Hyphae
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Hypovirulence
mitochondrial DNA and, 397–416

I

Idaho
Phellinus weirii and forest structure, 517, 519–20
Image processing
cell biology imaging of plant-microbe interactions and, 448
impala element
horizontal gene transfer in fungal evolution and, 339
India
advances in plant health management and, 103
citrus blight and, 192
epidemiology as a science of patterns and, 74, 76
Induced resistance
microbes for nematode control, 431–33
Induction
bacterial lipopolysaccharides and, 241, 246–53
Infants
Food Quality Protection Act and, 577–94
Infectious agents
citrus blight and, 181–99
Inhibitors
molecular diagnostic technologies and, 207–11, 214, 222, 225–26, 229
Innate immunity
host-parasite interactions and, 42
Inoculum potential
epidemiology as a science of patterns and, 76
Inonotus sulpharascens
Phellinus weirii and forest structure, 521
Insects
closteroviruses and, 293–315
Integrated pest management (IPM)
advances in plant health management and, 95–113
epidemiology as a science of patterns and, 88
Food Quality Protection Act and, 587–91
Intercellular pathogens
photoactivated *Cercospora* toxin cercosporin and, 461–83
Internal transcribed spacer (ITS) regions
molecular diagnostic technologies and, 207, 216–17
rust fungi and, 51
Internationally acceptable tests
molecular diagnostic technologies and, 228–29
Introns
horizontal gene transfer in

ecology and biogeography of microorganisms on plant surfaces, 156
Methanocorpusculum spp.
ecology and biogeography of microorganisms on plant surfaces, 156
Methanosaeta spp.
ecology and biogeography of microorganisms on plant surfaces, 156
Methanosarcina spp.
ecology and biogeography of microorganisms on plant surfaces, 156–57
Methyl bromide
Food Quality Protection Act and, 585–89
Methylomonas spp.
ecology and biogeography of microorganisms on plant surfaces, 157
Mexico
advances in plant health management and, 103
epidemiology as a science of patterns and, 84
rust fungi and, 50
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 493–94, 496
Microarrays
molecular diagnostic technologies and, 207–29
Microdochium nivale
molecular diagnostic technologies and, 221
Microorganisms
ecology and biogeography of on plant surfaces
biofilms, 163–65
biogeographic model of plant surface, 147–50
conclusions, 170–71
demographic processes, 165–66
ecophysiology, 150–51
epiphytic microbial community, 150–65
habitat heterogeneity, 169–70
habitats, 146–63
importance of plant surface, 146–47
introduction, 146
molecular phylogenetic classification, 160
plant-microbe interactions, 167–69
population dynamics, 165–66
protected sites, 167
representative trophic and phenotypic assimilatory and dissimilatory biochemical reactions, 152–57
spatial variation, 166–67
temporal variation, 166–67
Microsphaeropsis spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Middle East
rust fungi and, 51
Mildews
epidemiology as a science of patterns and, 84–85, 87–88
Millennium
legacy for
a century of progress in plant pathology and, 1–16
Miniaturization
molecular diagnostic technologies and, 227–28
Minnesota
epidemiology as a science of patterns and, 76, 83
Minor crops
Food Quality Protection Act and, 577, 583–84
Mitochondria
horizontal gene transfer in fungal evolution and, 333–36
Mitochondrial DNA (mtDNA)
in senescence and hypovirulence of fungi and disease control potential
Aspergillus, 406
hypovirulence, 410–15
introduction, 398–99
Neurospora, 406–8
plasmids, 414–15
Podospora, 404–5
senescence, 399–410
Mitochondrial hypovirulence syndromes
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Modulation
bacterial lipopolysaccharides and, 241–56
Molecular biology
cell biology imaging of plant-microbe interactions and, 443–55
a century of progress in plant pathology and, 7–9
closteroviruses and, 299–300
nematode parasitism genes and, 370–76
Molecular diagnostic technologies
plant disease management and
biochips, 227–28
case study, 218–20
chemotaxis of zoospores and antibodies, 215

analysis of *Phytophthora*-caused epidemics, 563
Lipopolysaccharide (LPS)
plant responses to bacterial conclusions, 255–56
coumaroyl-tyramine, 250–51
defense-related genes, 247–48
feruloyl-tyramine, 250–51
growth kinetics, 245–46
hydroxycinnamoyl conjugates, 249–50
hypersensitive response, 243–46, 253–55
induction of defense-related responses, 246–53
introduction, 242–43
localized induced resistance in pepper, 248–49
salicylate, 248–49
suppression and nonspecific induction of defense-related responses by phytopathogenic bacteria, 251–53
Lithocarpus densiflora
Phellinus weirii and forest structure, 518
Little cherry disease virus
closteroviruses and, 301, 303
Localized induced resistance
bacterial lipopolysaccharides and, 245, 248–49
Logistic curve
epidemiology as a science of patterns and, 80, 82
Long-distance dispersal
wheat leaf/stem rust epidemiology in central Great Plains of USA, 505–7
Long-term bets
epidemiology as a science of patterns and, 71, 88–89
Long terminal repeats (LTRs)
horizontal gene transfer in fungal evolution and, 340
Losses
advances in plant health management and, 95, 101–2
epidemiology as a science of patterns and, 71, 85–87
Louisiana
horizontal gene transfer in fungal evolution and, 329
Lycopersicon esculentum
bacterial lipopolysaccharides and, 243
LysR family
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84

M

MACAW program
closteroviruses and, 305
Magnaporthe grisea
horizontal gene transfer in fungal evolution and, 338, 340
Maize white line mosaic virus
plant viruses and, 125
Mancozeb
Food Quality Protection Act and, 587
Maneb
Food Quality Protection Act and, 587
Maritime trade
epidemiology as a science of patterns and, 75–76
Matching
pathogen and host gene
epidemiology as a science of patterns and, 82–85
Maternal inheritance
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Mature trees
citrus blight and, 181–99
Mealybugs
closteroviruses and, 293–94, 304, 315
Mediterranean region
citrus blight and, 184–85
epidemiology as a science of patterns and, 75
molecular diagnostic technologies and, 219
Melampsora lini
host-parasite interactions and, 34
rust fungi and, 52, 55, 60
Meloidogyne spp.
microbes for nematode control, 424–26, 431
nematode parasitism genes and, 365–88
Membrane destruction
photoactivated *Cercospora* toxin cercosporin and, 461–83
Mengovirus
plant viruses and, 127
Metabolism
germling
rust fungi and, 55–56, 60–61
Metalaxyl
advances in plant health management and, 106
citrus blight and, 197
epidemiology as a science of patterns and, 84–85
Metalaxylyl
epidemiology as a science of patterns and, 89
Methanobacterium spp.

induced resistance, 431–33
introduction, 424–26
microbial pathogens, 426–29
organisms that reduce nematode damage, 427
parasitism, 433
pathogens of sedentary stages of nematodes on roots, 428–29
regulation of nematode populations, 433, 434
rhizobacteria, 425, 427, 429–30
tritrophic interactions, 434–36
types of interactions, 430–33
molecular diagnostic technologies and, 207–29
Neocallimastix spp.
horizontal gene transfer in fungal evolution and, 341–43
Netherlands
molecular diagnostic technologies and, 228
Neurospora spp.
a century of progress in plant pathology and, 5–6
horizontal gene transfer in fungal evolution and, 329–30, 335, 340
mitochondrial DNA in fungal senescence and hypovirulence, 406–8
New declines
citrus blight and, 184
New Zealand
citrus blight and, 194
Nicotiana spp.
citrus blight and, 195
molecular diagnostic technologies and, 211
plant viruses and, 120, 133
Nidovirales
closteroviruses and, 314
Nilgiri hills
epidemiology as a science of patterns and, 76
NIM1 gene
host-parasite interactions and, 37
Nitrospora spp.
ecology and biogeography of microorganisms on plant surfaces, 156
Nodulation
Rhizobium
host-parasite interactions and, 36
Nonhost resistance
bacterial
lipopolysaccharides and, 241–56
Nonlinear models
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 563
Nonspecific determinants
bacterial
lipopolysaccharides and, 241–56
Nonstructural gene products
plant viruses and, 117–38
Nonvertebrates
horizontal gene transfer in fungal evolution and, 343–44
North America
epidemiology as a science of patterns and, 85
molecular diagnostic technologies and, 217–18
western
Phellinus weirii and forest structure, 515–36
North Carolina
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 555
Food Quality Protection Act and, 585, 591
North Sea
epidemiology as a science of patterns and, 76
"Northers"
wheat leaf/stem rust epidemiology in central Great Plains of USA, 494
Northwest Forest Plan
Phellinus weirii and forest structure, 532
Nostoc spp.
ecology and biogeography of microorganisms on plant surfaces, 154, 158
horizontal gene transfer in fungal evolution and, 343
Nuclear gene transfer
experimental
horizontal gene transfer in fungal evolution and, 344–45
Nuclear rRNA genes
horizontal gene transfer in fungal evolution and, 335–36, 341–45
Nutrient cycling
Phellinus weirii and forest structure, 526–27

O

Odontoglossum ringspot virus
molecular diagnostic technologies and, 223
Oklahoma
wheat leaf/stem rust epidemiology in central Great Plains of USA, 501, 505–9
Old-growth forests
Phellinus weirii and forest structure, 529–30
Olpidium brassicae
citrus blight and, 194

comparison of detection methods, 213–14
conclusions, 227–28
cost, 223–24
development of acceptable tests, 214
direct detection or diagnosis of fungi, 220–22
DNA probes, 216
duration of testing, 224–25
fungi, 215–22
future trends, 227, 228
grapevine degeneration and decline, 210
grapevine leafroll, 211
grapevine rugose wood, 212–13
internationally acceptable tests, 228–29
introduction, 208
large-scale testing, 226–27
miniaturization, 227–28
PCR-differentiating amplicons by electrophoresis, 217–18
PCR-miscellaneous genes or spacers, 217
PCR-random sequences, 216
PCR-rDNA internal transcribed spacer, 216–17
Phytophthora spp., 215–20
quarantine policies and regulations, 222–27
sensitivity of testing, 224–25
specificity, 225–26
viruses, 209–14
why molecular testing for pathogens is not routine, 208–9
Molecular epidemiology
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 567–68
Molecular fossils
horizontal gene transfer in fungal evolution and, 329
Molecular plant virology
plant viruses and, 117–38
Monoclonal antibodies
molecular diagnostic technologies and, 207–29
Montana
Phellinus weirii and forest structure, 520
Moorea
horizontal gene transfer in fungal evolution and, 329
Moran's *I* statistic
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 558–59
Mortality
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
Mortality centers
Phellinus weirii and forest structure, 515, 517–18, 522–23, 528–29, 531
Mortierella spp.
ecology and biogeography of microorganisms on plant surfaces, 155
Mutualistic symbionts
cell biology imaging of plant-microbe interactions and, 443–55
ecology and biogeography of microorganisms on plant surfaces, 145–71
Mycelia
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Mycology
a century of progress in plant pathology and, 4–6
Mycosphaerella pinodes
host-parasite interactions and, 37
Mycoviruses
horizontal gene transfer in fungal evolution and, 330–32
Myzus persicae
closteroviruses and, 298

N

NDR1 gene
host-parasite interactions and, 37
Nebraska
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 493, 496, 505, 507
Nectria haematococca
horizontal gene transfer in fungal evolution and, 338
Nematode parasitism genes
conclusions, 387–88
direct molecular analysis, 370–76
functional analysis, 378–82
genetic models of plant parasitism by nematodes, 376–78
introduction, 366–67
nematode parasitism of plants, 367–70
origins, 382–85
regulation, 378–82
structural analysis, 378–82
targeting gene products, 385–87
Nematodes
biological control of antagonism, 426–29, 431–33
conclusions, 436–37
fungi, 427–28

pathogenicity gene control, 278–79
Penicillium spp.
horizontal gene transfer in fungal evolution and, 331
Peperomia polybotyra
horizontal gene transfer in fungal evolution and, 333
Peronospora tabacina
epidemiology as a science of patterns and, 84
Perylene-quinone toxins
photoactivated *Cercospora* toxin cercosporin and, 461–83
Pesticides
Food Quality Protection Act and, 577, 585, 588–89
Pests
advances in plant health management and, 95–113
epidemiology as a science of patterns and, 71–90
pH
citrus blight and, 196
Phakopsora pachyrhizi
rust fungi and, 53
Phc confinement sensing system
five-gene *Ralstonia solanacearum* virulence and pathogenicity gene control, 263–79, 281–84
Phellinus weirii
forest structure in western North America and diversity, 524–25
ecosystem management, 532–33
forest managemement, 531–32
forest structure, 522, 524
introduction, 516–17
modeling root disease, 534–36
nutrient cycling, 526–27
old-growth forests, 529–30
pathology of organism, 519–21
population structure of organism, 521–23
primeval forest, 517–19
recent changes in forest, 530–31
succession, 524–25
tree vigor, 527–29
Philippines
epidemiology as a science of patterns and, 75
Phloem
closteroviruses and, 293, 298
^{32}Phosphorus
rust fungi and, 61
Photoactivation
Cercospora toxin cercosporin and, 461–83
Photosynthesis
epidemiology as a science of patterns and, 71, 85
PHYLIP programs
closteroviruses and, 305–7
Phyllosphere
ecology and biogeography of microorganisms on plant surfaces, 145–71
host-parasite interactions and, 43
Phylogenetic analysis
closteroviruses and, 293, 304–9
ecology and biogeography of microorganisms on plant surfaces, 145, 160
Physiology
a century of progress in plant pathology and, 4–7
Phytoalexins
host-parasite interactions and, 39
Phytophthora spp.
citrus blight and, 189–90, 197
epidemiology as a science of patterns and, 77, 84
host-parasite interactions and, 35
molecular diagnostic technologies and, 208, 215–20, 228
Phellinus weirii and forest structure, 531
Phytophthora spp.-caused epidemics
dispersal and spatial analysis
aerial dispersal from sporulating lesions on leaves, stems, or fruit, 551–53
autocorrelation tests, 558–60
BB and BW statistics for binary data, 554–56
clusters, 557
conclusions, 569
disease cycles, 544
dispersal by human or invertebrate activity, 553
dispersal of inoculum in soil, 546–48
Geary's *c* ratio, 558, 559
generalized linear models for spatial data, 563
introduction, 542
linear models for spatial data, 563
mechanisms of dispersal, 544–53
molecular epidemiology, 567–68
Moran's *I* statistic, 558–59
new frontiers for research, 563–69
nonlinear models for

Omphalia flavida
host-parasite interactions and, 34
Once-in-a-lifetime epidemics
epidemiology as a science of patterns and, 89
Oncogenes
plant viruses and, 126
Open reading frames (ORFs)
closteroviruses and, 299–301, 303–4, 308–11
horizontal gene transfer in fungal evolution and, 332, 334–36
Ophiobolus graminis
host-parasite interactions and, 34
Ophiostoma novo-ulmi
horizontal gene transfer in fungal evolution and, 331
Oregon
Phellinus weirii and forest structure, 517–36
Organelles
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Organophosphates
Food Quality Protection Act and, 587
Ornamentals
advances in plant health management and, 95–113
Orpinomyces spp.
horizontal gene transfer in fungal evolution and, 341–43
"Overcoming"
advances in plant health management and, 98
Overwintering
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Oxidative stress
photoactivated *Cercospora* toxin cercosporin and, 461–83
Oxygen
cell biology imaging of plant-microbe interactions and, 443, 451
photoactivated *Cercospora* toxin cercosporin and, 461–83
Ozonium omnivorum
history of research, 22

P

Pacific Northwest
advances in plant health management and, 99, 105
Phellinus weirii and forest structure, 515–36
Pacific Ocean
Phellinus weirii and forest structure, 517
Paenibacillus azotofixans
ecology and biogeography of microorganisms on plant surfaces, 154
Pakistan
epidemiology as a science of patterns and, 74
PAL genes
bacterial lipopolysaccharides and, 251
3-OH Palmitic acid methyl ester
Ralstonia solanacearum virulence and pathogenicity gene control, 271–75
Pantoea agglomerans
ecology and biogeography of microorganisms on plant surfaces, 154
Parasitism
host-parasite interactions and, 31–44
microbes for nematode control, 423–37
nematodes and, 365–88
Partial autocorrelation
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 559
Patchiness
pattern
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
Pathogen detection
molecular diagnostic technologies and, 207–29
plant viruses and, 117–38
Pathogenesis-related (PR) proteins
bacterial lipopolysaccharides and, 241–56
Pathogenicity islands
nematode parasitism genes and, 388
Patterns
epidemiology as a science of, 71–90
pCRY1 plasmid
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Peach mosaic virus
molecular diagnostic technologies and, 223
Peach tree short life
citrus blight and, 181, 195–96
Pectinolytic enzymes
Ralstonia solanacearum virulence and pathogenicity gene control, 268–69, 278–79
pehSR gene
Ralstonia solanacearum virulence and

fungal senescence and hypovirulence, 397–416
Plasmodesmata
plant viruses and, 117–38
Plum pox virus
molecular diagnostic technologies and, 225
Podospora spp.
mitochondrial DNA in fungal senescence and hypovirulence, 404–5
horizontal gene transfer in fungal evolution and, 330, 334, 336
Point source
horizontal distribution of urediniospores from wheat leaf/stem rust epidemiology in central Great Plains of USA, 504–5
Policies
Food Quality Protection Act and, 592–93
molecular diagnostic technologies and, 222–27
Poliovirus
plant viruses and, 121
Polyketides
photoactivated *Cercospora* toxin cercosporin and, 461–83
Polymerase chain reaction (PCR)
citrus blight and, 190, 193
horizontal gene transfer in fungal evolution and, 339
molecular diagnostic technologies and, 207–29
Poncirus trifoliata
citrus blight and, 189–90
Population biology
advances in plant health management and, 95–97, 110, 112–13
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 542, 567–68
ecology and biogeography of microorganisms on plant surfaces, 165–66
microbes for nematode control, 433–34
Phellinus weirii and forest structure, 515, 521–23
Portugal
molecular diagnostic technologies and, 213
Potato late blight
epidemiology as a science of patterns and, 84, 87, 89
Potato scab
epidemiology as a science of patterns and, 74
Potato virus T
molecular diagnostic technologies and, 212
Potato virus X
host-parasite interactions and, 42
plant viruses and, 121
Potyviridae
molecular diagnostic technologies and, 223–24
plant viruses and, 125
Potyvirus tobacco etch virus
plant viruses and, 131
Pratylenchus sp.
citrus blight and, 197
Precision agriculture applications
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 568–69
Prh system
Ralstonia solanacearum virulence and pathogenicity gene control, 263–67, 270, 281–84
Primary inoculum
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Primeval forest
Phellinus weirii and forest structure, 517–19
Prion diseases
host-parasite interactions and, 39
Producer costs
Food Quality Protection Act and, 577–94
Production systems
Food Quality Protection Act and, 577–94
Promoter genes
plant viruses and, 130–31
Ralstonia solanacearum virulence and pathogenicity gene control, 276–78
Propagules
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 542–70
PROPLANT program
epidemiology as a science of patterns and, 88
Proteases
closteroviruses and, 308
plant viruses and, 131
Protected sites
ecology and biogeography of microorganisms on plant surfaces, 167
Proteins
citrus blight and, 190
Ralstonia solanacearum virulence and pathogenicity gene control, 268–69
Protoplasts
plant viruses and, 127
PROTPARS program
closteroviruses and, 306–7
Pseudococcidae

spatial data, 563
novel methods of disease management, 563–69
partial autocorrelation, 559
population genetics, 567–68
precision agriculture applications, 568–69
reasons for spatial pattern study, 542–44
regression models for spatial data, 560–63
regularity, 557
semivariograms and spatial autocorrelation, 559–60
spatial analysis by distance indices, 557–58
spatial autocorrelation, 554–56, 559–60
spatial interaction models, 561–62
splash dispersal from soil to leaves, stems, and fruit, 550–51
statistical measures for measuring and documenting spatial heterogeneity, 553–63
2DCLASS analysis, 557
2DCORR analysis, 557
water dispersal of inoculum in irrigation and surface water, 548–50
Pig genes
rust fungi and, 57
Pinus spp.
Phellinus weirii and forest structure, 518, 529
Piromyces spp.
horizontal gene transfer in fungal evolution and, 341–43
Planococcus spp.
closteroviruses and, 304
Plant health management
airborne hazards, 107–9
benchmark yields for crops, 98–101
biological control, 109–11
clean, high-quality irrigation water, 106–7
clean planting material, 102–3
clean soil, 103–6
crop loss, 101–2
crops, 98–101
definitions, 97–98
introduction, 96–97
as "moving target", 111–13
root health management, 103–6
Plant-microbe interactions
cell biology imaging and, 443–55
Plant-parasitic nematodes
microbes for nematode control, 423–37
Plant protection
rust fungi and, 50–51
Plant viruses
agroinfection, 129
bioassay, 120
cDNA clones, 129
classical discovery period (1883–1951), 119–22
co-suppression, 133–34
cross protection, 120
defective interfering viruses, 126
diagnostic improvements, 128
early discoveries about the nature of viruses and their transmission, 119–20
early molecular era (1952–1983), 122–28
evolution, 135–36
future research, 136–38
gene functions, 123–25
genetic engineering, 130, 132–33
genome organization, 123–25
host inhibitory responses, 133–34
introduction, 118–19
in vitro replication, 127–28
plant resistance genes, 133
proteases, 131
protoplasts, 127
purification and characterization of miscellaneous viruses, 121–22
recent period (1984–2000), 128–36
recombination, 135–36
recovery mechanisms, 133–34
replicases, 127–28
reporter gene expression, 132
reverse genetics, 129–30
ribozymes, 131
RNA infectivity, 122
satellites, 125–26
subgenomic RNA, 123–25
symptomatological bases, 123
synergy mechanisms, 133–34
tobacco mosaic virus, 121–23
transcription promoters and terminators, 130–31
transgenes, 135
translational enhancers, 131
vectors, 132, 135
viral chemotherapy, 123
viral genes and sequences, 129–30
viroids, 126–27
Plasmids
horizontal gene transfer in fungal evolution and, 325, 328–30
mitochondrial DNA in

molecular diagnostic technologies and, 216
RdRp motifs
closteroviruses and, 306
Reactive oxygen species
cell biology imaging of plant-microbe interactions and, 443, 451
Recalcitrant etiology
citrus blight and, 181–99
Recombination
closteroviruses and, 309–11
plant viruses and, 117, 135–36
Recovery mechanisms
plant viruses and, 133–34
Rediversification
epidemiology as a science of patterns and, 84
Regression models
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 560–63
Regulation
microbes for nematode control, 433–34
nematode parasitism genes and, 378–82
photoactivated Cercospora toxin cercosporin and, 481–83
Ralstonia solanacearum virulence and pathogenicity gene control, 267–83
Regulatory decisions
Food Quality Protection Act and, 577–94
Replant diseases
citrus blight and, 181, 196–97
Replicases
plant viruses and, 127–28
Replicative genes
closteroviruses and, 293–315
plant viruses and, 127–28
Reporter genes
plant viruses and, 132
Reproductive population growth
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–40
Resistance
bacterial lipopolysaccharides and, 241–56
host-parasite interactions and, 31–44
nematode parasitism genes and, 365–88
photoactivated *Cercospora* toxin cercosporin and, 461–81
plant viruses and, 117, 132–33
rust fungi and, 49–62
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 509–10
Response regulator
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Restless transposon
horizontal gene transfer in fungal evolution and, 339–40
Retrohoming
horizontal gene transfer in fungal evolution and, 333
Reverse genetics
plant viruses and, 129–30
Rhizobium spp.
bacterial lipopolysaccharides and, 255
nodulation
host-parasite interactions and, 36
Rhizoctonia cerealis
molecular diagnostic technologies and, 220
Rhizoctonia solani
advances in plant health management and, 103–5, 108–9
citrus blight and, 197
horizontal gene transfer in fungal evolution and, 331
microbes for nematode control, 425
Rhizosphere
ecology and biogeography of microorganisms on plant surfaces, 145–71
host-parasite interactions and, 43
microbes for nematode control, 423–37
Rhododendron macrophylum Phellinus weirii and forest structure, 530
Rhodosporidium spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Ribes spp.
rust fungi and, 51
Ribosomal RNA (rRNA)
ecology and biogeography of microorganisms on plant surfaces, 171
horizontal gene transfer in fungal evolution and, 332, 335–36
molecular diagnostic technologies and, 216–17
Ribosomes
rust fungi and, 51
Ribozymes
plant viruses and, 131
Ridomil

closteroviruses and, 298, 304
Pseudomonas spp.
advances in plant health management and, 107, 110–11
bacterial lipopolysaccharides and, 243, 246–47, 252
a century of progress in plant pathology and, 3–4, 7, 9
ecology and biogeography of microorganisms on plant surfaces, 154, 159
host-parasite interactions and, 35
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Pseudotsuga menziesii
Phellinus weirii and forest structure, 518
Psorosis
citrus blight and, 181, 191–93
Pto gene
a century of progress in plant pathology and, 9
host-parasite interactions and, 37
Public land management
Phellinus weirii and forest structure, 515–36
Puccinia graminis
epidemiology as a science of patterns and, 83
rust fungi and, 50–61
"Puccinia pathway"
wheat leaf/stem rust epidemiology in central Great Plains of USA, 493
Puccinia spp.
epidemiology as a science of patterns and, 76
rust fungi and, 54
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Pycniospores
rust fungi and, 58–59
Pyrodoxine
photoactivated *Cercospora* toxin cercosporin and, 461, 476–81
Pyrus spp.
rust fungi and, 59
Pythium spp.
advances in plant health management and, 103–6, 108–9
citrus blight and, 197
molecular diagnostic technologies and, 215, 218

Q

Quarantines
epidemiology as a science of patterns and, 75–76
molecular diagnostic technologies and, 207–29
Quercus spp.
Phellinus weirii and forest structure, 518
Quorum sensing
Ralstonia solanacearum virulence and pathogenicity gene control, 263, 280

R

Races
epidemiology as a science of patterns and, 82
Rain splash dispersal
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 550–51
Ralstonia solanacearum
bacterial lipopolysaccharides and, 243–44, 246, 248, 254
a century of progress in plant pathology and, 3, 8
virulence and pathogenicity gene control
cellulolytic enzymes, 269
colonization factors, 279–80
complex multicomponent control, 277–79
conclusions, 284
disease, 265–66
endogenous signal molecule, 271–75
eps promoter, 276–77
exopolysaccharide I, 267–68
exoproteins, 268–69
hrp, 269–70, 280–83
introduction, 264
3-OH palmitic acid methyl ester, 271–75
pectinolytic enzymes, 268–79
pehSR, 278–79
Phc confinement sensing system, 271–79
phytopathogenicity, 264–65
Prh system, 280–83
regulatory systems and networks, 270–83
signal transduction, 271–76
solRI quorum sensing system, 280
Tek protein, 269
virulence and pathogenicity factors, 267–70
vsrA/vsrD, 279–80
Random sequences

of microorganisms on plant surfaces, 145–71
Seed
Food Quality Protection Act and, 593
Semipersistent transmission
closteroviruses and, 293–315
Semivariograms
spatial autocorrelation and dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 559–60
Senescence
fungal
mitochondrial DNA and, 397–416
Sensory apparatus
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Septoria tritici
molecular diagnostic technologies and, 221
Sequeira L, 1–16
Serologically-specific electron microscopy (SSEM)
citrus blight and, 192
Serology
molecular diagnostic technologies and, 207–29
Sexual incompatibility system
Phellinus weirii and forest structure, 521
Shear CL, 19–28
Shifty pathogens
epidemiology as a science of patterns and, 89
Short-term decisions
epidemiology as a science of patterns and, 87, 88
Siberia
Phellinus weirii and forest structure, 521
Signal transduction
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Silencing
gene
plant viruses and, 117–38
Single-stranded RNA (ssRNA)
citrus blight and, 193
closteroviruses and, 293–315
Singlet oxygen
photoactivated *Cercospora* toxin cercosporin and, 461–83
Siskyou Mountains
Phellinus weirii and forest structure, 525
Small farms
Food Quality Protection Act and, 590
Social issues
advances in plant health management and, 95–138
Food Quality Protection Act and, 590
Soilborne fungi
citrus blight and, 181–99
Soil fumigants
advances in plant health management and, 95–113
Soils
advances in plant health management and, 103–6
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 546–48
solRI quorum sensing system
Ralstonia solanacearum virulence and pathogenicity gene control, 280
Sour cherry green ring mottle
molecular diagnostic technologies and, 212
South Carolina
Food Quality Protection Act and, 585
South Dakota
wheat leaf/stem rust epidemiology in central Great Plains of USA, 506, 508
Southern corn leaf blight
epidemiology as a science of patterns and, 75, 80, 82, 86
Spain
citrus blight and, 192
closteroviruses and, 310
Spatial analysis by distance indices (SADIE)
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 557–58
Spatial interaction models
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 561–62
Spatial pattern analysis
Phytophthora-caused epidemics and, 541–70
Spatial variation
ecology and biogeography of microorganisms on plant surfaces, 166–67
Specialist microorganisms
microbes for nematode control, 423–37
Specificity
molecular diagnostic technologies and, 207, 225–26
Spizellomyces spp.
ecology and biogeography of microorganisms on plant surfaces, 155

epidemiology as a science of patterns and, 84
Rio Grand gummosis
citrus blight and, 181, 197–98
Risk assessment
Food Quality Protection Act and, 577–94
RNA infectivity
plant viruses and, 122
RNA viruses
citrus blight and, 181–99
Rocky Mountains
Phellinus weirii and forest structure, 517–18, 520
Root-graft inoculations
citrus blight and, 181–99
Root knots
microbes for nematode control, 423–37
nematode parasitism genes and, 365–88
Root rot
citrus blight and, 181, 198
Phellinus weirii and forest structure, 515, 529
Root tips
ecology and biogeography of microorganisms on plant surfaces, 145–71
Roots
advances in plant health management and, 95–113
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Rootstocks
citrus blight and, 189–90
Rothamsted Experimental Station
epidemiology as a science of patterns and, 77–78
Round-up
advances in plant health management and, 105
Rows
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541–70
Rpg2 gene
a century of progress in plant pathology and, 7
Rps2 gene
host-parasite interactions and, 37
Rubus arcticus
molecular diagnostic technologies and, 217
Rugose wood
grapevine
molecular diagnostic technologies and, 212–13
Rust fungi
aeciospores, 58–59
axenic culture, 59
basidiospores, 58
conclusions, 61–62
historical importance, 59
host-parasite complex
genetics, 60
metabolism, 60–61
molecular genetics, 60
introduction, 50
plant protection, 50–51
pycniopores, 58–59
taxonomy, 51–52
teliospores, 53, 57–58
urediospores (urediniospores)
germling development, 53–55
germling metabolism, 55–56
haustoria, 56–57
physiological races, 52
race genotypes, 52
ultrastructure, 52
Rusts
advances in plant health management and, 95–113
epidemiology as a science of patterns and, 74–75, 83, 86, 88
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491

S

Saccharomyces cerevisiae
horizontal gene transfer in fungal evolution and, 335–36, 340, 342–44
Safety factors
Food Quality Protection Act and, 577–94
Salicylate
bacterial lipopolysaccharides and, 248–49
Salmonella minnesota
bacterial lipopolysaccharides and, 244, 247
Saprophytes
ecology and biogeography of microorganisms on plant surfaces, 145–71
Satellites
plant viruses and, 125–26, 131
Schizosaccharomyces pombe
horizontal gene transfer in fungal evolution and, 333
Science of patterns
epidemiology as, 71–90
Sclerotium spp.
ecology and biogeography of microorganisms on plant surfaces, 155
Scotland
molecular diagnostic technologies and, 228
Secretory glands
nematode parasitism genes and, 365–88
Sediment
ecology and biogeography

Tek protein
Ralstonia solanacearum virulence and pathogenicity gene control, 269
Teliospores
rust fungi and, 49, 53, 57–58
Temporal factors
epidemiology as a science of patterns and, 79–82
Temporal variation
ecology and biogeography of microorganisms on plant surfaces, 166–67
Terminators
transcription
plant viruses and, 130–31
Tetracycline
citrus blight and, 188
Tetrahymena spp.
horizontal gene transfer in fungal evolution and, 333
Texas
citrus blight and, 192
epidemiology as a science of patterns and, 76
rust fungi and, 50
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491, 493–94, 496, 505–6, 509
Thermofilum spp.
ecology and biogeography of microorganisms on plant surfaces, 157
Thermoplasma spp.
ecology and biogeography of microorganisms on plant surfaces, 156–57
Thinning treatments
Phellinus weirii and forest structure, 532
Thuja plicata
Phellinus weirii and forest structure, 519
Thyroid function
Food Quality Protection Act and, 583
Tillage
advances in plant health management and, 95, 104
wheat leaf/stem rust epidemiology in central Great Plains of USA, 495
Tilletia spp.
advances in plant health management and, 103
Timber trees
advances in plant health management and, 95–113
Ti plasmid
host-parasite interactions and, 42
Tissue tropism
closteroviruses and, 298–99
Tobacco blue mold
epidemiology as a science of patterns and, 76, 84–85, 88
Tobacco mild green mosaic virus
plant viruses and, 125
Tobacco mosaic virus
a century of progress in plant pathology and, 8
host-parasite interactions and, 39, 42
molecular diagnostic technologies and, 224
plant viruses and, 117–38
Tobacco necrosis virus
citrus blight and, 194
plant viruses and, 125
Tobacco rattle virus
plant viruses and, 122
Tobacco ringspot virus
plant viruses and, 126
Tobacco stunt virus
citrus blight and, 194
Tobamoviruses
molecular diagnostic technologies and, 223, 225
Tolerance establishment
Food Quality Protection Act and, 584–85
Tolypocladium inflatum
horizontal gene transfer in fungal evolution and, 339–40
Tomato bushy stunt virus
plant viruses and, 121
Tomato mosaic virus
molecular diagnostic technologies and, 224
plant viruses and, 125
Tonnage
epidemiology as a science of patterns and, 85–86
Tospoviruses
molecular diagnostic technologies and, 224
Toxicity
citrus blight and, 187
Food Quality Protection Act and, 577, 582, 587, 589
photoactivated *Cercospora* toxin cercosporin and, 461–83
Toxoptera citricida
closteroviruses and, 298, 312
Trafficking
cell biology imaging of plant-microbe interactions and, 443–55
Transcriptional regulation
plant viruses and, 130–31
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Transgenes
advances in plant health management and, 106–7, 112
cell biology imaging of

Splash dispersal
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 550–51
Spores
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 551–53
epidemiology as a science of patterns and, 77–79
rust fungi and, 71–90
Sporobolomyes spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Spreading within a locality
epidemiology as a science of patterns and, 77–79
Sri Lanka
rust fungi and, 51
Stagnospora nodorum
molecular diagnostic technologies and, 221
Stand-replacing events
Phellinus weirii and forest structure, 515–36
Stem rust
epidemiology of central Great Plains of USA and, 491–510
Stems
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 550–53
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Sternorrhyncha spp.
closteroviruses and, 298
Stochastic loss
horizontal gene transfer in fungal evolution and, 338
Storage depots
closteroviruses and, 312
Streptavidin
molecular diagnostic technologies and, 226
Streptococcus spp.
ecology and biogeography of microorganisms on plant surfaces, 159
Streptomyces griseus
advances in plant health management and, 110
Strix occidentalis caurina
Phellinus weirii and forest structure, 530
Stylet
nematode parasitism genes and, 365–88
Subgenomic RNA
plant viruses and, 123–25
Succession
Phellinus weirii and forest structure, 524–25
Succession of limiting factors
advances in plant health management and, 98
Supernumerary chromsome
horizontal gene transfer in fungal evolution and, 325–53
Supply and demand
epidemiology as a science of patterns and, 71–90
Suppression
bacterial lipopolysaccharides and, 251–53
"Suppressive" mtDNA mutations
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Surface water
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 548–50
Sustainability
Phellinus weirii and forest structure, 532
Sweden
molecular diagnostic technologies and, 228
Switzerland
molecular diagnostic technologies and, 221
Symbiosis
ecology and biogeography of microorganisms on plant surfaces, 145–71
Symbiotraphina spp.
ecology and biogeography of microorganisms on plant surfaces, 155
Synergy mechanisms
plant viruses and, 133–34
Systemic acquired resistance
plant viruses and, 117–38

T

Tahiti
horizontal gene transfer in fungal evolution and, 329
Take-off
epidemiology as a science of patterns and, 78
Tapesia spp.
molecular diagnostic technologies and, 220–21
Target promoters
nematode parasitism genes and, 385–87
Ralstonia solanacearum virulence and pathogenicity gene control, 276–78
Taxonomy
closteroviruses and, 313–14
molecular diagnostic technologies and, 207–29
rust fungi and, 51–52

wheat leaf/stem rust epidemiology in central Great Plains of USA, 503–4
Vertical resistance
epidemiology as a science of patterns and, 71–90
Verticillium spp.
microbes for nematode control, 431, 435–36
molecular diagnostic technologies and, 221
Vibrio parahaemolyticus
ecology and biogeography of microorganisms on plant surfaces, 146–47
Vicia faba
horizontal gene transfer in fungal evolution and, 331
Video microscopy
cell biology imaging of plant-microbe interactions and, 446–47
Viniviruses
closteroviruses and, 314
Virions
closteroviruses and, 293–315
Viroids
plant viruses and, 126–27
Virulence
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Viruses
cell biology imaging of plant-microbe interactions and, 443–55
a century of progress in plant pathology and, 8
citrus blight and, 181–99
closteroviruses and, 293–315
epidemiology as a science of patterns and, 89
horizontal gene transfer in fungal evolution and, 330–32
host-parasite interactions and, 39, 42
molecular diagnostic technologies and, 207, 209–14
plant viruses and virus diseases, 117–38
Vitamin B6
photoactivated *Cercospora* toxin cercosporin and, 461, 476–81
Vitis vinifera
closteroviruses and, 314
Vitiviruses
molecular diagnostic technologies and, 212
Volunteer wheat destruction
wheat leaf/stem rust epidemiology in central Great Plains of USA, 509
vsrA/vsrD system
Ralstonia solanacearum virulence and pathogenicity gene control, 279–80

W

Washington State
citrus blight and, 197
Phellinus weirii and forest structure, 517, 534
Water
advances in plant health management and, 106–7
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 541, 548–50
Weather
epidemiology as a science of patterns and, 71, 77
West Nile virus
epidemiology as a science of patterns and, 89
Western Disease Root Model (WRDM) projection
Phellinus weirii and forest structure, 534–36
Wheat leaf/stem rust epidemiology
in central Great Plains of USA
adult plant resistance genes, 509–10
canopy dispersal, 501–3
early studies of stem rust epidemics, 494
escape, 503, 509
gene deployment, 510
gene pyramid, 510
horizontal dispersal of urediniospores from point source, 504–5
introduction, 492–93
liberation of urediniospores, 498–501
long-distance dispersal of urediniospores, 505–7
modeling development and establishment of rust, 495–97
spore production, 497–98
strategies for managing rust epidemics, 509–10
urediniospores, 498–501
vertical distribution of urediniospores in atmosphere, 503–4
volunteer wheat destruction, 509
Wheat rust
epidemiology as a science of patterns and, 74, 83, 86
Wheat stripe rust
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491

plant-microbe interactions and, 443–55
host-parasite interactions and, 31–44
plant viruses and, 135
Transient epiphytic saprophytes
ecology and biogeography of microorganisms on plant surfaces, 145–71
Translational enhancers
plant viruses and, 131
Transmission
citrus blight and, 181–99
closteroviruses and, 293, 298
mitochondrial DNA in fungal senescence and hypovirulence, 397–416
Transposable elements
horizontal gene transfer in fungal evolution and, 325, 337–41
Traps
epidemiology as a science of patterns and, 77–78
Tree vigor
Phellinus weirii and forest structure, 515, 527–29
Trees
advances in plant health management and, 95–113
citrus blight and, 181–99
Trialeurodes spp.
closteroviruses and, 302
Trichoderma spp.
advances in plant health management and, 109
horizontal gene transfer in fungal evolution and, 342
molecular diagnostic technologies and, 218, 221
Trichovirus
molecular diagnostic technologies and, 212
Tricothecene 3-O-acetyltransferase
horizontal gene transfer in fungal evolution and, 344
Triticum aestivum
rust fungi and, 51
wheat leaf/stem rust epidemiology in central Great Plains of USA, 491
Tritrophic interactions
microbes for nematode control, 423, 434–36
Tropism
tissue
closteroviruses and, 298–99
Tsuga spp.
Phellinus weirii and forest structure, 518
Turkey
advances in plant health management and, 103
Turnip yellow mosaic virus
plant viruses and, 121
2DCLASS analysis
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 557
2DCORR analysis
dispersal and spatial analysis of *Phytophthora*-caused epidemics, 557
Tyramine
bacterial lipopolysaccharides and, 241, 250–51

U

United Kingdom
molecular diagnostic technologies and, 221
United States
advances in plant health management and, 99, 101, 103–5, 107, 109–10
citrus blight and, 184–85, 188–89, 192, 194, 197
closteroviruses and, 310–11
epidemiology as a science of patterns and, 75–89
Food Quality Protection Act and, 577–94
horizontal gene transfer in fungal evolution and, 329
host-parasite interactions and, 44
molecular diagnostic technologies and, 213
Phellinus weirii and forest structure, 517–20, 522–29, 531, 533–36
plant viruses and, 121–22
rust fungi and, 50–51
stem rust epidemiology in central Great Plains of USA, 491–510
Urediospores (Urediniospores)
rust fungi and, 49–62
wheat leaf/stem rust epidemiology in central Great Plains of USA, 494, 498–501, 503–7
Uruguay
citrus blight and, 192

V

Vectors
closteroviruses and, 293, 300–1, 308
plant viruses and, 132, 135
Venezuela
citrus blight and, 184–85
Venturia inequalis
a century of progress in plant pathology and, 6
Vertebrates
host-parasite interactions and, 42
Vertical distribution
urediniospore

White pine blister rust fungus
rust fungi and, 51
Whiteflies
closteroviruses and, 293–94, 302–4, 315
Whole chromosomes
horizontal gene transfer in fungal evolution and, 351–52
Wildfire
Phellinus weirii and forest structure, 515, 522
Wilt
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
Winds
wheat leaf/stem rust epidemiology in central Great Plains of USA, 494
Wisconsin
epidemiology as a science of patterns and, 77

X

Xanthomonas campestris
bacterial lipopolysaccharides and, 243–54
a century of progress in plant pathology and, 8
host-parasite interactions and, 36–37
Xylella fastidiosa
citrus blight and, 181, 189–91
host-parasite interactions and, 37
Xylem vessels
citrus blight and, 186–88, 190
Ralstonia solanacearum virulence and pathogenicity gene control, 263–84
XYNA program
horizontal gene transfer in fungal evolution and, 341

Y

Yersinia spp.
a century of progress in plant pathology and, 8
Yield
advances in plant health management and, 95–138

Z

Zinc
citrus blight and, 185
Zoospores
molecular diagnostic technologies and, 215